



EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.03.2020 Bulletin 2020/12

(51) Int Cl.:
D01H 1/08 (2006.01)

(21) Application number: **19191654.3**

(22) Date of filing: **14.08.2019**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **KONDO, Toshiki**
Kariya-shi,, Aichi 448-8671 (JP)
• **NAKAMURA, Yusuke**
Kariya-shi,, Aichi 448-8671 (JP)
• **TSUCHIDA, Daisuke**
Kariya-shi,, Aichi 448-8671 (JP)

(30) Priority: **11.09.2018 JP 2018169258**

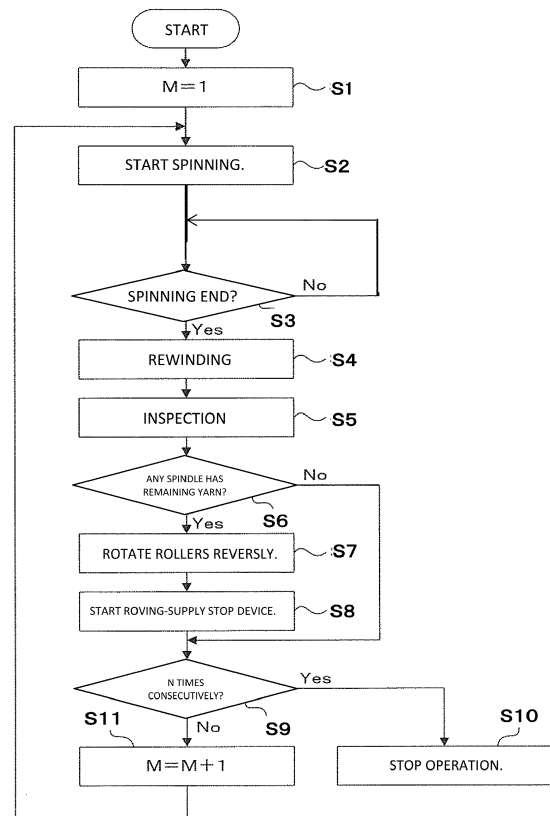
(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(71) Applicant: **Kabushiki Kaisha Toyota Jidoshokki**
Kariya-shi, Aichi 448-8671 (JP)

(54) **METHOD FOR CONTROLLING POT SPINNING MACHINE**

(57) A method for controlling a pot spinning machine (1) includes spinning a yarn (20) supplied from a drafting device (2) in a pot (5, 5-1, 5-2, 5-3) of each of spindles (61, 62, 63), rewinding the yarn (20) spun in the pot (5, 5-1, 5-2, 5-3) onto a bobbin (25), and inspecting each spindle (61, 62, 63) to determine whether a remaining yarn exists in the pot (5, 5-1, 5-2, 5-3) between the end of the rewinding performed after the spinning and the start of next spinning. The method further includes starting a roving-supply stop device (3) of the spindle (61, 62, 63) that is determined in the inspecting as the spindle in which the remaining yarn exists to prevent the yarn (20) from being spun in the pot (5, 5-1, 5-2, 5-3) in the next spinning.

FIG. 3



Description

[0001] The present disclosure relates to a method for controlling a pot spinning machine.

BACKGROUND

[0002] In a pot spinning machine, yarn that has been drawn out by a drafting device is introduced to a pot by a yarn introduction pipe, and the introduced yarn is spun through an end of the yarn introduction pipe to be deposited on an inside wall of the pot, and the yarn is then rewound onto a bobbin. If rewinding of the yarn fails for any reason, the yarn supposed to be rewound onto the bobbin remains in the pot at the end of a rewinding step. The yarn that remains in the pot at the end of the rewinding step is referred to as "remaining yarn" herein.

[0003] If the remaining yarn exists in the pot at the end of the rewinding step, the yarn spun in the pot in a next spinning step (hereinafter also referred to as "another yarn") is deposited on the remaining yarn. This makes a cake formed on the inside wall of the pot thicker than a usual cake. Accordingly, the yarn introduction pipe may contact the cake during the yarn spinning in the pot, or the bobbin inserted into the pot for yarn rewinding may contact the cake.

[0004] Japanese Patent Application Publication No. 2001-081634 mentions, for example, a technique to inspect whether the remaining yarn exists in the pot, through a phenomenon that the presence of the remaining yarn reduces a rotary frequency of a yarn leg which rotates around the yarn introduction pipe when the yarn is spun in the pot through the end of the yarn introduction pipe. More specifically, a rotary frequency of the yarn leg is detected during the spinning of the yarn, and the detected rotary frequency of the yarn leg is compared with a predetermined set value of the rotary frequency to inspect the presence of the remaining yarn in the pot.

[0005] However, the technique mentioned in Japanese Patent Application Publication No. 2001-081634 can detect the rotary frequency of the yarn leg only after the start of spinning of the yarn. If the remaining yarn exists in the pot, the yarn spun in the pot for detection of the frequency of the yarn leg is deposited on the remaining yarn. Accordingly, the yarn introduction pipe may contact a cake, or the bobbin may contact a cake, as described above. Further, even if the yarn could be rewound onto the bobbin, a mixture of the remaining yarn and the another yarn is rewound onto the bobbin. The remaining yarn and another yarn get entangled with each other when the yarn is wound from the bobbin in a next winding step, so that both the remaining yarn and the another yarn become unusable yarn, in other words, "waste yarn".

[0006] The present disclosure, which has been made in light of the above-mentioned problem, is directed to providing a method for controlling a pot spinning machine that prevents another yarn from being deposited on the remaining yarn in a pot even if yarn rewinding fails.

SUMMARY

[0007] In accordance with an aspect of the present disclosure, there is provided a method for controlling a pot spinning machine. The pot spinning machine includes a plurality of spindles. Each spindle includes a drafting device, a roving-supply stopping device, and a pot. The drafting device includes a pair of back rollers, a pair of middle rollers, and a pair of front rollers that are arranged in that order from an upstream to a downstream of a roving delivery direction. The drafting device is configured to draw out a roving by using rotations of the pair of back rollers, the pair of middle rollers, and the pair of front rollers. The roving-supply stopping device is configured to stop supply of the roving to the drafting device. The pot rotates at a predetermined rotational speed. The method includes spinning a yarn supplied from the drafting device in the pot of each of the spindles, rewinding the yarn spun in the pot onto a bobbin, and inspecting each spindle to determine whether a remaining yarn exists in the pot between the end of the rewinding performed after the spinning and the start of next spinning. The method further comprises starting the roving-supply stop device of at least one of the spindles that is determined in the inspecting as the spindle in which the remaining yarn exists to prevent the yarn from being spun in the pot in the next spinning.

[0008] Other aspects and advantages of the disclosure will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present disclosure together with objects and advantages thereof, may best be understood by reference to the following description of the embodiments together with the accompanying drawings in which:

FIG. 1 is a schematic view illustrating an exemplary configuration of a pot spinning machine according to an embodiment of the present disclosure;

FIG. 2 is a block diagram illustrating an exemplary configuration of a drive control system of the pot spinning machine according to the embodiment of the present disclosure;

FIG. 3 is a flowchart for describing a method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 4 is a diagram illustrating an example of a concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 5 is a diagram illustrating an example of the concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 6 is a diagram illustrating an example of the concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 7 is a diagram illustrating an example of the concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 8 is a diagram illustrating an example of the concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 9 is a diagram illustrating an example of the concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure;

FIG. 10 is a diagram for describing technical importance of inverse rotation of a pair of back rollers and a pair of middle rollers;

FIG. 11 is a diagram for describing the technical importance of inverse rotation of the pair of back rollers and the pair of middle rollers;

FIG. 12 is a diagram for describing the technical importance of inverse rotation of the pair of back rollers and the pair of middle rollers; and

FIG. 13 is a diagram for describing the technical importance of inverse rotation of the pair of back rollers and the pair of middle rollers;

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0010] The following will describe an embodiment of the present disclosure with reference to the accompanying drawings.

<Configuration of pot spinning machine>

[0011] First, a configuration of a pot spinning machine according to an embodiment of the present disclosure will be described.

[0012] FIG. 1 is a schematic view illustrating an exem-

plary configuration of a pot spinning machine according to an embodiment of the present disclosure.

[0013] As illustrated in FIG. 1, a pot spinning machine 1 includes a drafting device 2, a roving-supply stop device 3, a yarn introduction pipe 4, a pot 5, a bobbin support part 6, and an inspection device 7. These elements cooperate to form a single spindle that represents a unit of spinning. The pot spinning machine 1 includes a plurality of spindles, and each of the spindles has a common configuration. The following will focus on a configuration of the single spindle.

(Drafting device)

[0014] The drafting device 2 is a device that draws out a roving 9, which is a yarn material, to a predetermined thickness. The drafting device 2 includes multiple pairs of rollers, such as a pair of back rollers 15, a pair of middle rollers 16, and a pair of front rollers 17. The pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17 are arranged in that order from upstream to downstream of a roving delivery direction.

[0015] The pair of back rollers 15 includes a top back roller 15a and a bottom back roller 15b. The top back roller 15a and the bottom back roller 15b are in contact with each other under a predetermined pressure. The top back roller 15a is a driven roller, and the bottom back roller 15b is a driving roller. The top back roller 15a is rotated by rotation of the bottom back roller 15b.

[0016] The pair of middle rollers 16 includes a top middle roller 16a and a bottom middle roller 16b. The top middle roller 16a and the bottom middle roller 16b are in contact with each other under a predetermined pressure. The top middle roller 16a is a driven roller, and the bottom middle roller 16b is a driving roller. The top middle roller 16a is rotated by rotation of the bottom middle roller 16b. The pair of middle rollers 16 is wound with a pair of aprons 19. The pair of aprons 19 includes a top apron 19a and a bottom apron 19b. The top apron 19a is wound over the top middle roller 16a, and the bottom apron 19b is wound over the bottom middle roller 16b.

[0017] The pair of front rollers 17 includes a top front roller 17a and a bottom front roller 17b. The top front roller 17a and the bottom front roller 17b are in contact with each other under a predetermined pressure. The top front roller 17a is a driven roller, and the bottom front roller 17b is a driving roller. The top front roller 17a is rotated by rotation of the bottom front roller 17b.

[0018] The pairs of rollers 15, 16, and 17 are rotated by a drafting-device driving section described later. The drafting-device driving section rotates the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17, at respective predetermined rotational speeds. When the rotational speeds of the pairs of rollers 15, 16, and 17 are defined by revolutions per minute (rpm), the rpm of the pair of middle rollers 16 is greater than the rpm of the pair of back rollers 15, and the rpm of the pair of front rollers 17 is greater than the rpm of

the pair of middle rollers 16. As described above, the rpm of the pairs of rollers 15, 16, and 17 are different from each other, and the drafting device 2 draws out the roving 9 by using the rotations of the pairs of rollers 15, 16, 17, specifically, by using the difference in rpm among the pair of rollers 15, 16, 17, that is, the difference in rotational speed among the pairs of rollers 15, 16, 17. A yarn 20 that has been drawn out by the drafting device 2 to a predetermined thickness is supplied from the drafting device 2 to the yarn introduction pipe 4 through a yarn suction pipe 22.

(Roving-supply stop device)

[0019] The roving-supply stop device 3 includes a wedge 8 that is movable toward or away from the pair of back rollers 15 of the drafting device 2. The roving-supply stop device 3 stops supply of the roving 9 to the drafting device 2 by the wedge 8 driven between the two rollers of the pair of back rollers 15, i.e., the top back roller 15a and the bottom back roller 15b.

[0020] When the roving-supply stop device 3 is started, the wedge 8 is moved toward the pair of back rollers 15. The wedge 8 is driven between the top back roller 15a and the bottom back roller 15b. The wedge 8 blocks the transmission of the rotation of the bottom back roller 15b to the top back roller 15a. Further, the roving 9 is caught between the top back roller 15a and the wedge 8. This prevents the rotation of the bottom back roller 15b from providing a delivery force to the roving 9. This therefore stops the supply of the roving 9 to the drafting device 2.

(Yarn introduction pipe)

[0021] The yarn introduction pipe 4 introduces the yarn 20, which has been supplied from the drafting device 2 through the yarn suction pipe 22, to the pot 5. The yarn 20 drawn out by the drafting device 2 is introduced into the yarn suction pipe 22, for example, by swirling air flow, and the yarn 20 is further introduced into the yarn introduction pipe 4 through the yarn suction pipe 22. The yarn introduction pipe 4 has a long thin tube-like shape. The yarn introduction pipe 4 has a circular cross section in a direction perpendicular to a longitudinal direction of the yarn introduction pipe 4. The yarn introduction pipe 4 is disposed downstream of the drafting device 2, and is coaxial with the pot 5. A lower portion of the yarn introduction pipe 4 is disposed in the pot 5. The yarn introduction pipe 4 has a yarn outlet 4a at a bottom end of the yarn introduction pipe 4. The yarn 20 introduced into the yarn introduction pipe 4 is discharged from the yarn outlet 4a of the yarn introduction pipe 4 for spinning. The yarn introduction pipe 4 is moved up and down by a yarn-introduction-pipe driving section described later.

(Pot)

[0022] The pot 5 is used for formation of a cake 24 and

rewinding of the yarn 20. The pot 5 has a cylindrical shape. The pot 5 is rotatable with respect to a central axis of the pot 5. The central axis of the pot 5 referred to as K is parallel to a vertical direction. Accordingly, one side of the pot 5 is an upper side, and the other side is a lower side in the central axis K direction. The pot 5 is rotated by a pot driving section described later. The pot 5 has an opening 5a at a bottom end of the pot 5. The cake 24 is a deposit of the yarn 20 that is formed on an inside wall 5b of the pot 5.

(Bobbin support part)

[0023] The bobbin support part 6 supports a bobbin 25. The bobbin support part 6 is moved up and down by a bobbin driving section described later. The bobbin support part 6 includes a bobbin seat 26 and a bobbin attachment portion 27. The bobbin seat 26 has a plate-like shape. The bobbin attachment portion 27 is fixed to the bobbin seat 26.

[0024] The bobbin attachment portion 27 is a portion to which the bobbin 25 is attachable. The bobbin attachment portion 27 is arranged coaxially with the yarn introduction pipe 4 and the pot 5 such that the bobbin attachment portion 27 faces the yarn introduction pipe 4 on the central axis K of the pot 5. The bobbin attachment portion 27 is disposed below the yarn introduction pipe 4. Accordingly, the bobbin 25 faces the yarn introduction pipe 4 on the central axis K of the pot 5 in a state where the bobbin 25 is attached to the bobbin attachment portion 27.

(Inspection device)

[0025] The inspection device 7 inspects whether the remaining yarn exists in the pot 5. The inspection device 7 includes a camera 31 for capturing images and an image processor 32. The camera 31 captures an image of the inside of the pot 5, and outputs the captured image data. The image processor 32 processes the image data output from the camera 31, and determines whether the remaining yarn exists in the pot 5. The inspection device 7 including the camera 31 and the image processor 32 may include a plurality of inspection device 7 corresponding to a plurality of spindles of the pot spinning machine 1, alternatively, may be a single inspection device 7 provided for the plurality of spindles.

[0026] In the present embodiment, a single inspection device 7 is provided for a plurality of spindles, as an example. In that case, the single inspection device 7 has to capture an image of the inside of each pot of all the spindles. In the present embodiment, the inspection device 7 is mounted on a movable wagon, which is not illustrated, so as to inspect the pot 5 of each of all the spindles to determine whether the remaining yarn exists in the pot 5. The plurality of spindles of the pot spinning machine 1 is arranged along a longitudinal direction of a frame of the pot spinning machine 1. Accordingly, the

wagon is movable in a direction in which the plurality of spindles of the pot spinning machine 1 are arranged.

[0027] The wagon moves to locate the camera 31 mounted on the wagon below the pot 5 of each of the spindles, and the camera 31 captures an image of the inside of the pot 5 of the spindle in sequence. The image processor 32 receives image data output from the camera 31, and processes the image data. If the remaining yarn exists in the pot 5 whose image is captured by the camera 31, the image data output from the camera 31 shows a predetermined difference in luminance at a boundary P between a surface of the inside wall 5b of the pot 5 and the remaining yarn, as illustrated in FIG. 1. In the image processing, the image processor 32 determines that the remaining yarn exists when the image processor 32 detects that there is a portion at which a predetermined difference in luminance is shown, meanwhile, the image processor 32 determines that the remaining yarn does not exist when the image processor 32 detects that there is no portion at which a predetermined difference in luminance is shown.

[0028] FIG. 2 is a block diagram illustrating an exemplary configuration of a drive control system of the pot spinning machine according to the embodiment of the present disclosure.

[0029] As illustrated in FIG. 2, the pot spinning machine 1 includes a controller 50, a drafting-device driving section 51, a wedge driving section 52, a yarn-introduction-pipe driving section 53, a pot driving section 54, a bobbin driving section 55, and a wagon driving section 56.

(Controller)

[0030] The controller 50 centrally controls the operation of the whole pot spinning machine 1. The controller 50 is electrically connected to the drafting-device driving section 51, the wedge driving section 52, the yarn-introduction-pipe driving section 53, the pot driving section 54, the bobbin driving section 55, and the wagon driving section 56, which are controlled by the controller 50. The controller 50 is also electrically connected to the inspection device 7. Each of the drafting-device driving section 51, the yarn-introduction-pipe driving section 53, the pot driving section 54, the bobbin driving section 55, and the wagon driving section 56 is provided for the plurality of spindles, and the wedge driving section 52 is provided for each of the spindles.

(Drafting-device driving section)

[0031] The drafting-device driving section 51 rotates the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17, at respective predetermined rotational speeds. The drafting-device driving section 51 rotates the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17 by a control command provided to the drafting-device driving section 51 from the controller 50.

(Wedge driving section)

[0032] The wedge driving section 52 drives the wedge 8 of the roving-supply stop device 3. The wedge driving section 52 drives the wedge 8 to move toward or move away from the pair of back rollers 15 by the control command provided to the wedge driving section 52 from the controller 50. For start of the operation of the roving-supply stop device 3, the controller 50 commands the wedge driving section 52 to drive the wedge 8 to move toward the pair of back rollers 15, and for stop of the operation of the roving-supply stop device 3, the controller 50 commands the wedge driving section 52 to drive the wedge 8 to move away from the pair of back rollers 15,

(Yarn-introduction-pipe driving section)

[0033] The yarn-introduction-pipe driving section 53 drives the yarn introduction pipe 4. The yarn-introduction-pipe driving section 53 drives the yarn introduction pipe 4 to move up and down by the control command provided to the yarn-introduction-pipe driving section 53 from the controller 50.

(Pot driving section)

[0034] The pot driving section 54 rotates the pot 5. The pot driving section 54 drives to rotate the pot 5 with respect to the central axis K of the pot 5 by the control command provided to the pot driving section 54 from the controller 50.

(Bobbin driving section)

[0035] The bobbin driving section 55 drives the bobbin 25. The bobbin driving section 55 drives the bobbin 25 attached to the bobbin attachment portion 27 to move up and down together with the bobbin seat 26 by the control command provided to the bobbin driving section 55 from the controller 50.

(Wagon driving section)

[0036] The wagon driving section 56 drives the above-described wagon. The wagon driving section 56 drives the wagon to move together with the inspection device 7 by the control command provided to the wagon driving section 56 from the controller 50.

(Inspection device)

[0037] The inspection device 7 notifies the controller 50 of a result of the inspection performed by using the camera 31 and the image processor 32. A unique identification data is assigned to each of the spindles of the pot spinning machine 1. The wagon moves with the inspection device 7 so that the inspection device 7 captures an image of the inside of the pot 5 of each spindle by

using the camera 31, and the inspection device 7 processes captured image data by using the image processor 32. The image processor 32 determines for each spindle whether the remaining yarn exists in the corresponding pot 5. When the image processor 32 detects the spindle in which the remaining yarn exists in the corresponding pot 5, the image processor 32 notifies the controller 50 of the identification data of the detected spindle as an inspection result. When the remaining yarn does not exist in the pot 5 of any of the spindles, that is, when yarn rewinding is performed successfully in all of the spindles, the image processor 32 notifies the controller 50 of the successful rewinding as an inspection result.

<Operation of pot spinning machine>

[0038] Next, basic operation of the pot spinning machine according to the embodiment of the present disclosure will be described.

[0039] The pot spinning machine 1 performs steps that include, at least, a spinning step in which the yarn 20 supplied from the drafting device 2 is spun in the pot 5 and a rewinding step in which the yarn 20 spun in the pot 5 is rewound onto the bobbin 25. The operation of the pot spinning machine 1 in the spinning step and the rewinding step will be described. Both the spinning step and the rewinding step are performed in a state where the pot 5 is rotated at a predetermined rotational speed. The controller 50 provides a control command to the pot driving section 54 to drive the pot 5 to rotate at the predetermined rotational speed when the operation of the pot spinning machine 1 is started, and in this state, the pot spinning machine 1 performs the spinning step.

(Spinning step)

[0040] The controller 50 provides a control command to the drafting-device driving section 51 to rotate the pair of back rollers 15, the pair of middle rollers 16, and the pair of front rollers 17 at respective predetermined rotational speeds. The rotations of the pairs of rollers 15, 16, and 17 deliver the roving 9. The rotational speed of the pair of middle rollers 16 is greater than the rotational speed of the pair of back rollers 15, and the rotational speed of the pair of front rollers 17 is greater than the rotational speed of the pair of middle rollers 16. The roving 9 is drawn out to a predetermined thickness by differences in rotational speed between the pairs of rollers 15, 16, and 17.

[0041] The yarn 20 that has been drawn out by the drafting device 2 is introduced from the drafting device 2 into the yarn introduction pipe 4 through the yarn suction pipe 22. The yarn 20 that has been introduced into the yarn introduction pipe 4 is discharged from the yarn outlet 4a of the yarn introduction pipe 4 for spinning and spun onto the inside wall 5b of the pot 5 by a centrifugal force generated by the rotation of the pot 5. The yarn 20 is twisted by the rotation of the pot 5.

[0042] Next, the controller 50 provides a control command to the yarn-introduction-pipe driving section 53 to drive the yarn introduction pipe 4 to displace the yarn introduction pipe 4 relatively downward while driving the yarn introduction pipe 4 to move up and down repeatedly at predetermined intervals. This allows a predetermined amount of the yarn 20 to be deposited on the inside wall 5b of the pot 5. Accordingly, the cake 24 is formed on the inside wall 5b of the pot 5. The controller 50 provides a control command to the drafting-device driving section 51 to perform the yarn cutting. More specifically, the controller 50 provides the control command to the drafting-device driving section 51 to stop both the rotation of the pair of back rollers 15 and the rotation of the pair of middle rollers 16 while keeping the rotation of the pair of front rollers 17. Accordingly, the yarn cutting is performed immediately near the pair of front rollers 17. Then, the spinning step ends.

(Rewinding step)

[0043] First, the controller 50 provides a control command to the bobbin driving section 55 to drive the bobbin seat 26 to move upward while commanding the pot driving section 54 to drive the pot 5 to rotate at the predetermined rotational speed as described above. The bobbin 25 moves upward together with the bobbin seat 26. The bobbin 25 enters the pot 5 through the opening 5a of the pot 5. Accordingly, the bobbin 25 is inserted into the pot 5. Further, the controller 50 provides a control command to the yarn-introduction-pipe driving section 53 to drive the yarn introduction pipe 4 to move upward in order to prevent the bobbin 25 inserted into the pot 5 from contacting the yarn introduction pipe 4.

[0044] Next, the controller 50, for example, commands a feeler driving section, which is not illustrated, to drive a feeler to contact the inside wall 5b of the pot 5, in order to remove the yarn 20 wound on a bottom end of the cake 24 from the inside wall 5b of the pot 5. Consequently, the yarn 20 removed from the inside wall 5b of the pot 5 is wound onto the bobbin 25, and this starts yarn rewinding onto the bobbin 25.

[0045] After all the yarn 20 of the cake 24 is rewound onto the bobbin 25, the controller 50 provides a control command to the bobbin driving section 55 to drive the bobbin seat 26 to move downward. Consequently, the bobbin 25 onto which the yarn 20 is rewound, i.e., the full bobbin 25, is removed from the pot 5. Then, the rewinding step ends.

[0046] When the above-described spinning step and rewinding step are performed in sequence, the yarn rewinding may fail for any reason. If the yarn rewinding fails, all or part of the yarn 20 of the cake 24 becomes the remaining yarn that remains in the pot 5. This causes another yarn is deposited on the remaining yarn when another spinning step is performed in the spindle in which the remaining yarn exists in the pot 5. Therefore, in this embodiment, the pot spinning machine 1 is controlled as

described below.

[0047] FIG. 3 is a flowchart for describing a method for controlling the pot spinning machine according to the embodiment of the present disclosure. The shown method for controlling the pot spinning machine is performed under control of the controller 50.

[0048] First, the controller 50 sets a value of a variable M to an initial value of 1 (step S1). The variable M is an integer equal to or greater than one, indicating how many times each step is performed, and M = 1 means the first time, M = 2 means the second time, and M = 3 means the third time. For example, when M = 1 is set for a step that is performed this time, M = 2 is set for a step that will be performed next time. When M = 2 is set for a step that is performed this time, M = 1 is set for a step that was performed previous time, and M = 3 is set for a step that will be performed next time. The same applies to a case where the variable M is equal to or greater than 4.

[0049] Next, the controller 50 starts the first spinning step (step S2). In the first spinning step, the roving-supply stop device 3 of each of all the spindles is not in operation. When the roving-supply stop devices 3 are not in operation, the wedge 8 is at a position away from the pair of back rollers 15.

[0050] Next, the controller 50 determines whether the first spinning step has ended (step S3).

[0051] Next, when the controller 50 determines at step S3 that the first spinning step has ended, the controller 50 performs the first rewinding step (step S4). The rewinding step is performed in all the spindles simultaneously.

[0052] Next, the controller 50 starts the first inspection step (step S5). At the inspection step, the controller 50 uses the inspection device 7 to inspect the presence of the remaining yarn. More specifically, the controller 50 provides a control command to the wagon driving section 56 to move the wagon together with the inspection device 7. Consequently, the inspection device 7 inspects each spindle whether the remaining yarn exists in the corresponding pot 5, and notifies the controller 50 of the inspection result.

[0053] Next, the controller 50 determines whether the remaining yarn exists in the pot 5 of any of the spindles based on the inspection result that is notified by the inspection device 7 (step S6). The controller 50 determines to select Yes at step S6 when the inspection result notified by the inspection device 7 includes one or more spindle identification data, or determines to select No at step S6 when the inspection result does not include any spindle identification data.

[0054] When the controller 50 determines that the remaining yarn exists in at least one of the spindles at step S6, the controller 50 provides a control command to the drafting-device driving section 51 to rotate the pair of back rollers 15 and the pair of middle rollers 16 of each of all the spindles by a predetermined amount in a direction opposite to a roving delivery direction (hereinafter also referred to as "rotate reversely") (step S7). After the pair

of back rollers 15 and the pair of middle rollers 16 are rotated reversely, the rotation of the pair of back rollers 15 and the rotation of the pair of middle rollers 16 are stopped. Technical importance of the reverse rotation of the pair of back rollers 15 and the reverse rotation of the pair of middle rollers 16 at step S7 will be described later.

[0055] Next, the controller 50 starts the roving-supply stop device 3 of the spindle that has been determined at step S5 as the spindle in which the remaining yarn exists, in order to prevent the yarn 20 from being spun in the pot 5 in the next spinning step (step S8). More specifically, the controller 50 starts, of the roving-supply stop devices 3 correspond to the spindles, only the roving-supply stop devices 3 of the spindle that has been identified by the spindle identification data of the inspection result. The controller 50 provides a control command to the wedge driving section 52 that corresponds to the roving-supply stop device 3 of the spindle identified by the identification data. Accordingly, the wedge 8 moves toward the pair of back rollers 15 in the drafting device 2 of the spindle identified by the identification data. This causes a state where the wedge 8 is driven between the top back roller 15a and the bottom back roller 15b of the pair of back rollers 15.

[0056] When the controller 50 determines at step S6 that the remaining yarn does not exist in any of the spindles, step S9 is performed directly after step S6.

[0057] Next, the controller 50 determines whether it is determined in the inspection step at step S5 consecutively N times that the remaining yarn exists in any/one of the pots 5 (step S9). The number of times it is determined that the remaining yarn exists in the pot 5 in the inspection step at step S5 means the number of times the yarn rewinding fails in the rewinding step at step S4. "N" is an integer that is equal to or greater than two, and is predetermined in consideration with an effect on productivity that may be caused by failure of rewinding. For example, "N" is set to a value within a range from three to five.

[0058] When the controller 50 determines to select Yes at step S9, the controller 50 stops the operation of the pot spinning machine 1 (step S10). When the operation of the pot spinning machine 1 is stopped, the rotation of the pot 5 is stopped in all the spindles. The pot 5 keeps rotating at the predetermined rotational speed from the start of the first spinning step to the stop of the operation of the pot spinning machine 1. Accordingly, the spinning step, the rewinding step, and the inspection step are performed without stop of the operation of the rotation of the pot 5.

[0059] In contrast, when the controller 50 determines to select No at step S9, the controller 50 increments the value of the variable M (step S11), and returns to step S2.

[0060] Next, the controller 50 starts the second spinning step at step S2. When the remaining yarn exists in the pot 5 of at least one of the spindles at the end of the first rewinding step, the second spinning step is started while the roving-supply stop device 3 of the spindle is in

operation. The roving 9 is not supplied to the drafting device 2 of the spindle whose roving-supply stop device 3 is in operation. The yarn 20 is not spun in the pot 5 of the spindle in which the remaining yarn exists when the second spinning step is started. Accordingly, another yarn is not deposited on the remaining yarn in the pot 5.

[0061] The controller 50 determines whether the second spinning step has ended (step S3).

[0062] After the controller 50 performs the second rewinding step (step S4), the controller 50 performs the second inspection step (step S5). The second rewinding step is performed for each of all the spindles regardless of the presence of the remaining yarn in the pot 5. The yarn rewinding may succeed in the second rewinding step, even if the yarn rewinding fails in the first rewinding step. For example, even if the yarn rewinding fails in the first rewinding step in a spindle having the identification data "007", the yarn rewinding may succeed in the second rewinding step in the spindle identified by identification data "007". In that case, the remaining yarn does not exist in the pot 5 of the spindle identified by the identification data "007" at the end of the second rewinding step. Accordingly, the inspection device 7 notifies the controller 50 of an inspection result not including the variable "007" in the second inspection step that is performed after the second rewinding step. Therefore, the third spinning step is started in the spindle identified by the identification data "007" to spin the yarn 20 in the corresponding pot 5.

[0063] The yarn rewinding may fail in the second rewinding step after the yarn rewinding failed in the first rewinding step, that is, the yarn rewinding may fail consecutively more than once. For example, if the yarn rewinding fails in the first rewinding step in a spindle having the identification data "003", the yarn rewinding may fail again in the second rewinding step in the spindle identified by identification data "003". In that case, the remaining yarn exists in the pot 5 of the spindle identified by the identification data "003" at the end of the second rewinding step. Accordingly, the inspection device 7 notifies the controller 50 of an inspection result of the second inspection step performed after the second rewinding step including the identification data "003". In that case, the controller 50 commands to reversely rotate the pair of back rollers 15 and the pair of middle rollers 16 at step S7 after determining to select Yes at step S6, and starts the roving-supply stop device 3 of the spindle identified by the variable "003" at step S8. The roving-supply stop device 3 stops the supply of the roving 9 to the drafting device 2 of the spindle identified by the identification data "003", so that the yarn 20 is not spun in the corresponding pot 5 in the third spinning step.

[0064] The following will describe an example of concrete operation of the pot spinning machine using the method for controlling the pot spinning machine according to the embodiment of the present disclosure with reference to FIGS. 4 to 9.

[0065] The following will describe focusing on three spindles of the plurality of spindles of the pot spinning

machine 1. The three spindles include a first spindle 61, a second spindle 62, and a third spindle 63. The first spindle 61 includes a yarn introduction pipe 4-1 and a pot 5-1, the second spindle 62 includes a yarn introduction pipe 4-2 and a pot 5-2, and the third spindle 63 includes a yarn introduction pipe 4-3 and a pot 5-3.

[0066] At the end of the first spinning step, as illustrated in FIG. 4, the pot 5-1 of the spindle 61, the pot 5-2 of the spindle 62, and the pot 5-3 of the spindle 63 respectively have therein a cake 24-1, a cake 24-2, and a cake 24-3. The cake 24-1 is made of a yarn 20-1 that is deposited on an inside wall of the pot 5-1. The cake 24-2 is made of a yarn 20-2 that is deposited on an inside wall of the pot 5-2, and the cake 24-3 is made of a yarn 20-3 that is deposited on an inside wall of the pot 5-3.

[0067] At the end of the first rewinding step, as illustrated in FIG. 5, the yarn 20-1 is rewound onto a bobbin 25-1 of the first spindle 61, and the yarn 20-3 is rewound onto a bobbin 25-3 of the third spindle 63. In contrast, the yarn 20-2 is not rewound onto a bobbin 25-2 in the second spindle 62 due to a rewinding failure, and thus, the cake 24-2 remains on the inside wall of the pot 5-2. The yarn 20-2 of the cake 24-2 in the pot 5-2 corresponds to the remaining yarn.

[0068] In the first inspection step, the camera 31 is moved in a direction represented by arrows in FIG. 6 to capture an image of the inside of the pot 5-1 of the first spindle 61, an image of the inside of the pot 5-2 of the second spindle 62, and an image of the inside of the pot 5-3 of the third spindle 63 in sequence, as illustrated in FIG. 6. At this time, only the yarn 20-2 remains in the pot 5-2 of the second spindle 62. In the first inspection step, it is determined that the remaining yarn does not exist in the pot 5-1 of the first spindle 61 and in the pot 5-3 of the third spindle 63, but it is determined that the remaining yarn exists in the pot 5-2 of the second spindle 62 because of the presence of the yarn 20-2. Accordingly, the roving-supply stop device 3 (FIG. 1) is not started in each of the first spindle 61 and the third spindle 63, but the roving-supply stop device 3 is started in the second spindle 62.

[0069] In the second spinning step, the yarn 20-1 is spun in the pot 5-1 of the first spindle 61 through the yarn introduction pipe 4-1, and the yarn 20-3 is spun in the pot 5-3 of the third spindle 63 through the yarn introduction pipe 4-3, as illustrated in FIG. 7. However, yarn is not spun in the pot 5-2 of the second spindle 62 since the roving-supply stop device 3 is in operation.

[0070] At the end of the second spinning step, as illustrated in FIG. 8, the pot 5-1 of the first spindle 61, the pot 5-2 of the second spindle 62, and the pot 5-3 of the third spindle 63 respectively have therein the cake 24-1, the cake 24-2, and the cake 24-3. The cake 24-1 and the cake 24-3 are formed in the second spinning step, and the cake 24-2 is formed in the first spinning step.

[0071] At the end of the second rewinding step, as illustrated in FIG. 9, the yarn 20-1 is rewound onto the bobbin 25-1 of the first spindle 61, and the yarn 20-2 and

the yarn 20-3 are rewound onto the bobbin 25-2 of the second spindle 62 and the bobbin 25-3 of the third spindle 63, respectively. In that case, the yarn rewinding succeeds in the second spindle 62 in the second rewinding step after the yarn rewinding failed in the second spindle 62 in the first rewinding step. Accordingly, the yarn 20-1, the yarn 20-2, and the yarn 20-3 are respectively spun in the pot 5-1 of the first spindle 61, the pot 5-2 of the second spindle 62, and the pot 5-3 of the third spindle 63 in the third spinning step.

[0072] The following will describe the technical importance of the reverse rotation of the pair of back rollers 15 and the reverse rotation of the pair of middle rollers 16 at step S7.

[0073] First, when the yarn cutting is performed after the cake 24 is formed, the rotation of the pair of back rollers 15 and the rotation of the pair of middle rollers 16 are stopped while the rotation of the pair of front rollers 17 is kept. Accordingly, an end 9a of the roving 9 is located immediately near the pair of front rollers 17 of the drafting device 2 after the yarn cutting, as illustrated in FIG. 10. When the next spinning step is performed in this state, the pair of middle rollers 16 and the pair of front rollers 17 are rotated with the wedge 8 driven between the top back roller 15a and the bottom back roller 15b in any spindle in which the roving-supply stop device 3 is in operation, as illustrated in FIG. 11. The roving 9 is drawn out and cut between the pair of back rollers 15 and the pair of middle rollers 16. Accordingly, a piece 9b of the roving 9 may be delivered into the corresponding pot 5 by the rotation of the pair of middle rollers 16 and the rotation of the pair of front rollers 17. The roving 9 delivered into the pot 5 may be discarded, but the discard of the roving 9 reduces a yarn bundle as row material, which decreases the productivity. The reverse rotations of the pair of back rollers 15 and the pair of middle rollers 16 become unnecessary if the rotation of the pair of back rollers 15 is stopped and the yarn cutting is performed while the rotation of the pair of front rollers 17 and the rotation of the pair of middle rollers 16 are kept, but this causes variation in the yarn cutting position among the spindles, which decreases the success rate of the rewinding or the success rate of the start of spinning, thereby decreases the productivity.

[0074] When the pair of back rollers 15 and the pair of middle rollers 16 are rotated reversely at step S7, the roving 9 is drawn back to upstream in the roving delivery direction, as illustrated in FIG. 12. In this state, the controller 50 controls an amount of rotation of the pair of back rollers 15 and an amount of rotation of the pair of middle rollers 16 via the drafting-device driving section 51, preferably, such that the end 9a of the roving 9 is moved from a position immediately near the pair of front rollers 17 to a position immediately near the pair of middle rollers 16. Accordingly, the roving 9 is not cut even if the pair of middle rollers 16 and the pair of front rollers 17 are rotated with the wedge 8 driven between the top back roller 15a and the bottom back roller 15b by the roving-supply stop

device 3, as illustrated in FIG. 13. This reduces the delivery of the piece 9b of the roving 9 into the pot 5. It is only required that the pair of back rollers 15 and the pair of middle rollers 16 are rotated reversely by at least an amount of rotation necessary for preventing the cutting of the roving 9 illustrated in FIG. 11.

<Advantageous effects of the embodiment

[0075] The method for controlling a pot spinning machine according to this embodiment of the present disclosure includes the inspection step performed between the end of the rewinding step performed after the spinning step and the start of the next spinning step to inspect each of the spindles whether the remaining yarn exists in the corresponding pot 5. Next, the roving-supply stop device 3 of the spindle that has been determined in the inspection step as the spindle in which the remaining yarn exists is started to prevent the yarn 20 from being spun in the pot 5 in the next spinning step. Accordingly, even if the yarn rewinding fails in a spindle in the rewinding step and thus the remaining yarn exists in the corresponding pot 5, the yarn 20 is prevented from being spun in the pot 5 in the next spinning step. This prevents another yarn from being deposited on the remaining yarn in the pot 5 even if the yarn rewinding fails.

[0076] In the embodiment of the present disclosure, the image of the inside of the pot 5 is captured by the camera 31, and data of the captured image is processed to determine whether the remaining yarn exists in the pot 5. This allows a determination whether the remaining yarn exists in the pot 5 without a contact on the remaining yarn. Accordingly, this allows the inspection step to be performed without loosening of the cake 24 that may be caused by the contact on the remaining yarn. Further, the inspection step enables an accurate determination without the stop of the rotation of the pot 5, by the difference in luminance at the boundary P between the surface of the inside wall 5b of the pot 5 and the remaining yarn, whether the remaining yarn exists in the pot 5.

[0077] In the embodiment of the present disclosure, when it is determined that the remaining yarn exists in the pot 5 of at least one of the spindles in the inspection step, the pairs of back rollers 15 and the pairs of middle rollers 16 of all of the spindles are rotated by a predetermined amount in the direction opposite to the roving delivery direction before the start of the roving-supply stop device 3 of the at least one spindle that is determined as the spindle in which the remaining yarn exists. This allows the roving 9 to be preliminarily drawn back upstream in the roving delivery direction to prevent the cutting of the roving 9 in the drafting device 2, even if the yarn rewinding fails in the spindle in the rewinding step and thus the remaining yarn exists in the corresponding pot 5.

[0078] In the embodiment of the present disclosure, the operation of the pot spinning machine 1 is stopped when it is determined in the inspection step consecutively N times that the remaining yarn exists in any/one of the

pots 5. This eliminates or minimizes the productivity loss since the operation of the pot spinning machine 1 is stopped at the stage where the yarn rewinding fails in the rewinding step consecutively N times.

<Modifications>

[0079] The technical scope of the present disclosure is not limited to the above-described embodiment, and includes various modifications and improvements in the scope capable of deriving a specific advantageous effect by constituting features of the present disclosure and a combination of the features.

[0080] In the above-described embodiment, the camera 31 captures an image of the inside of the pot 5, but not limited to this, the camera 31 may capture an image of the bobbin 25 removed from the pot 5 of each of the spindles after the rewinding step. In that case, an amount of yarn actually rewound onto the bobbin 25, a rewind region of the bobbin 25, and a shape of the deposit of the yarn rewound onto the bobbin 25 are different between the bobbin 25 in which the yarn rewinding succeeded and the bobbin 25 in which the yarn rewinding failed. In the bobbins 25 that are removed from the pots 5 and captured by the camera 31, these differences enable a determination whether the remaining yarn exists in any one of the pots 5, by detection of the differences, such as a difference in an amount of the yarn rewound onto each bobbin 25, through the image processing of image data of the bobbins 25. When the yarn rewinding succeeds in the rewinding step, the bobbin 25 has in a vicinity of an upper end of the bobbin 25 a thin-layer region where the yarn 20 is rewound once or a few times. This may allow a determination whether the remaining yarn exists in any of the pots 5, by detection of the differences, such as a difference in luminance and a difference in color between the bobbin 25 that has the thin-layer region and the bobbin 25 that does not have the thin-layer region, through the image processing of image data of the vicinity of the upper end of each bobbin 25 captured by the camera 31.

[0081] Further, the camera 31 and the image processor 32 are not necessarily required for the inspection step, and for example, a contact sensor may contact the inside wall 5b of the pot 5 to determine whether the remaining yarn exists in the pot 5.

[0082] In the embodiment of the present disclosure, the operation of the pot spinning machine 1 is controlled to stop when it is determined in the inspection step consecutively N times that remaining yarn exists in any/one of the pots 5, but the present disclosure is not limited to this embodiment. For example, the operation of the pot spinning machine 1 may be stopped when the number of spindles J, which is the number of spindles determined in a single inspection step performed after M times rewinding step as the spindles in each of which the remaining yarn exists in the corresponding pot 5 (in other words, the number of spindles in each of which the yarn rewinding

failed in M times rewinding step), exceeds a predetermined upper limit value. In this control method, the operation of the pot spinning machine 1 is kept as long as the number of spindles J, determined in a single inspection step as the spindles in each of which the remaining yarn exists in the corresponding pot 5, does not exceed the upper limit value even if the yarn rewinding fails consecutively in a particular small part of the spindles of the pot spinning machine 1. This allows the operation of the pot spinning machine 1 to be kept without stopping the operation even if the yarn rewinding fails consecutively in a particular small part of the spindles of the pot spinning machine 1 and the stop of the operation of the pot spinning machine 1 may cause large productivity loss. The above-described number of spindles J can be known by counting of the number of identification data that is included in the inspection result.

[0083] The roving-supply stopping device is not limited to a device including a wedge that is movable toward or away from a pair of back rollers and configured to stop supply of a roving to a drafting device by the wedge driven between two rollers of the pair of back rollers. For example, the roving supply stopping device 3 may be a known device that is configured to hold and cut a roving upstream of a pair of back rollers.

[0084] A method for controlling a pot spinning machine (1) includes spinning a yarn (20) supplied from a drafting device (2) in a pot (5, 5-1, 5-2, 5-3) of each of spindles (61, 62, 63), rewinding the yarn (20) spun in the pot (5, 5-1, 5-2, 5-3) onto a bobbin (25), and inspecting each spindle (61, 62, 63) to determine whether a remaining yarn exists in the pot (5, 5-1, 5-2, 5-3) between the end of the rewinding performed after the spinning and the start of next spinning. The method further includes starting a roving-supply stop device (3) of the spindle (61, 62, 63) that is determined in the inspecting as the spindle in which the remaining yarn exists to prevent the yarn (20) from being spun in the pot (5, 5-1, 5-2, 5-3) in the next spinning.

Claims

1. A method for controlling a pot spinning machine (1), the pot spinning machine (1) including a plurality of spindles (61, 62, 63), each spindle (61, 62, 63) comprising:

a drafting device (2) including a pair of back rollers (15), a pair of middle rollers (16), and a pair of front rollers (17) that are arranged in that order from an upstream to a downstream of a roving delivery direction, the drafting device (2) being configured to draw out a roving (9) by using rotations of the pair of back rollers (15), the pair of middle rollers (16), and the pair of front rollers (17);
a roving-supply stopping device (3) configured

to stop supply of the roving (9) to the drafting device (2); and
a pot (5, 5-1, 5-2, 5-3) that rotates at a predetermined rotational speed, the method comprising:

spinning a yarn (20) supplied from the drafting device (2) in the pot (5, 5-1, 5-2, 5-3) of each of the spindles (61, 62, 63);
rewinding the yarn (20) spun in the pot (5, 5-1, 5-2, 5-3) onto a bobbin (25); and
inspecting each spindle (61, 62, 63) to determine whether a remaining yarn exists in the pot (5, 5-1, 5-2, 5-3) between the end of the rewinding performed after the spinning and the start of next spinning, **characterized in that**

the method further comprises starting the roving-supply stop device (3) of at least one of the spindles (61, 62, 63) that is determined in the inspecting as the spindle in which the remaining yarn exists to prevent the yarn (20) from being spun in the pot (5, 5-1, 5-2, 5-3) in the next spinning.

2. The method for controlling the pot spinning machine (1) according to claim 1, **characterized in that** the inspecting comprises
capturing an image of an inside of the pot (5, 5-1, 5-2, 5-3) of each of the spindles (61, 62, 63) by a camera (31), and
processing data of the captured image to determine whether the remaining yarn exists in the pot (5, 5-1, 5-2, 5-3).
3. The method for controlling the pot spinning machine (1) according to claim 1 or 2, **characterized in that** the method further comprises rotating the pairs of back rollers (15) and the pairs of middle rollers (16) of all of the spindles (61, 62, 63) by a predetermined amount in a direction opposite to the roving delivery direction when it is determined in the inspecting that the remaining yarn exists in the pot (5, 5-1, 5-2, 5-3) of at least one of the spindles (61, 62, 63), before the start of the roving-supply stop device (3) of the at least one spindle that is determined as the spindle in which the remaining yarn exists.
4. The method for controlling the pot spinning machine (1) according to any one of claims 1 to 3, **characterized in that** the method further comprises stopping an operation of the pot spinning machine (1) when it is determined in the inspecting consecutively N times that the remaining yarn exists in any/one of the pots (5, 5-1, 5-2, 5-3) wherein N is an integer that is equal to or greater than two.

5. The method for controlling the pot spinning machine (1) according to any one of claims 1 to 3, **characterized in that** the method further comprises stopping an operation of the pot spinning machine (1) when the number of spindles (J) determined in the single inspecting as the spindles in each of which the remaining yarn exists in the corresponding pot (5, 5-1, 5-2, 5-3) exceeds a predetermined upper limit value.

FIG. 1

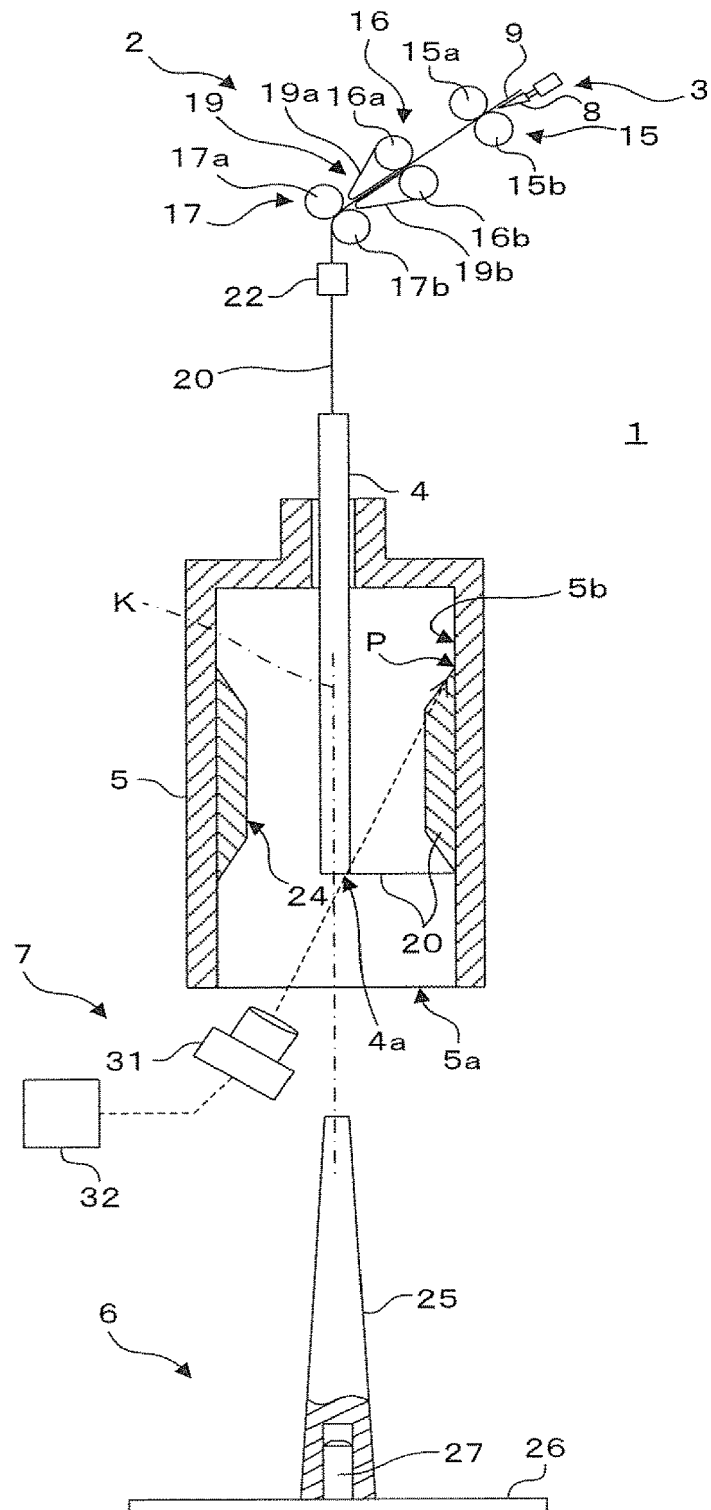


FIG. 2

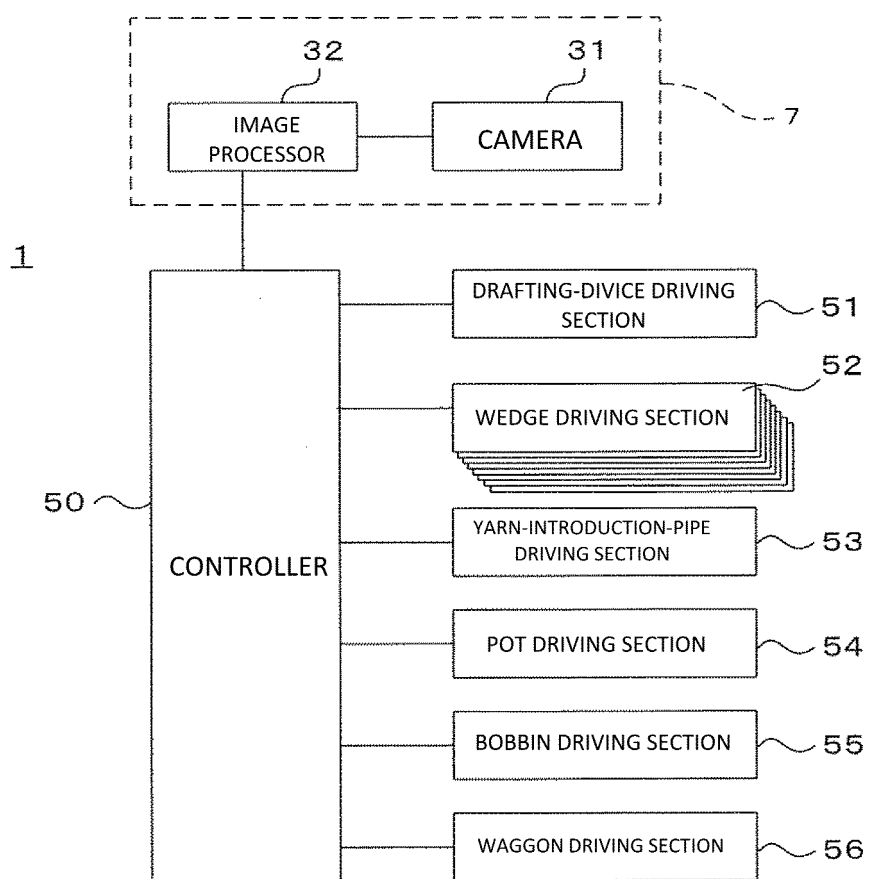


FIG. 3

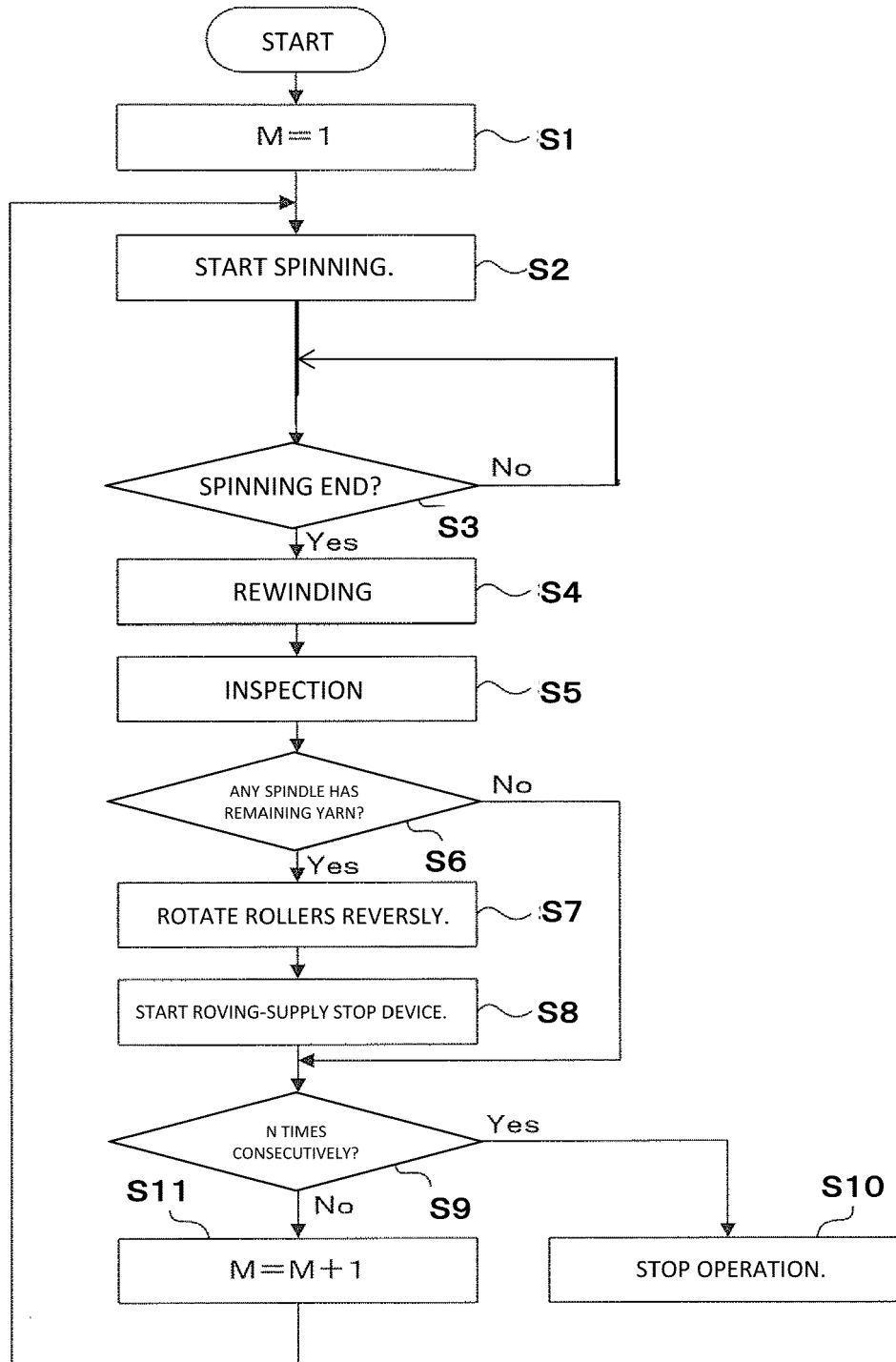


FIG. 4

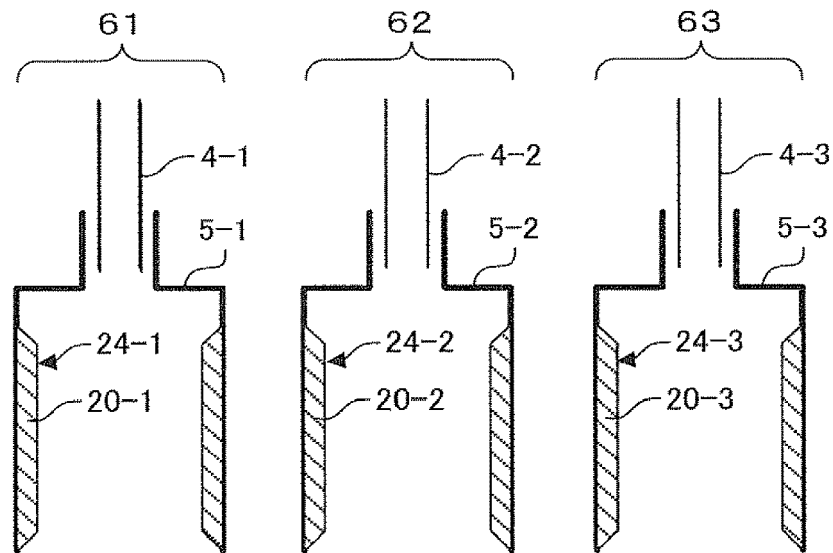


FIG. 5

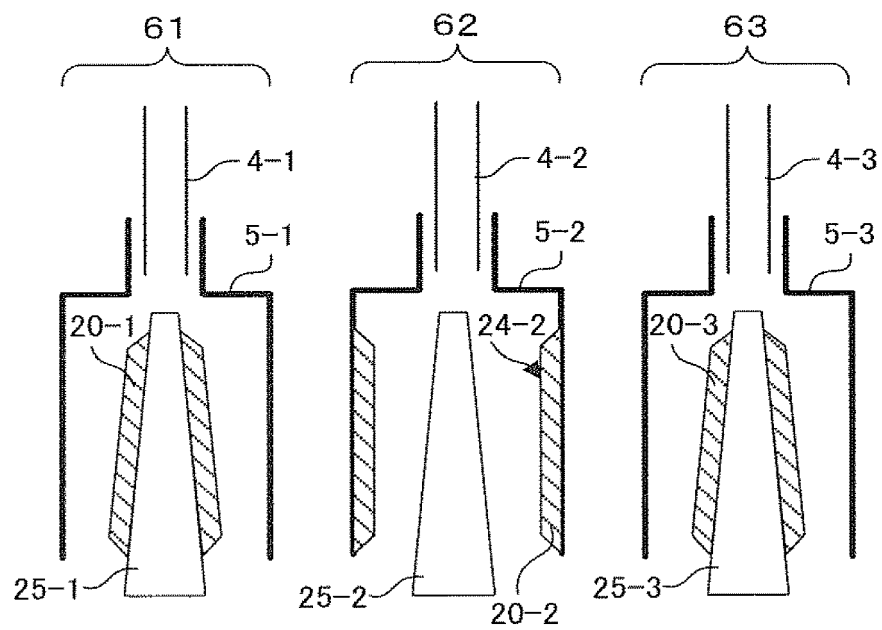


FIG. 6

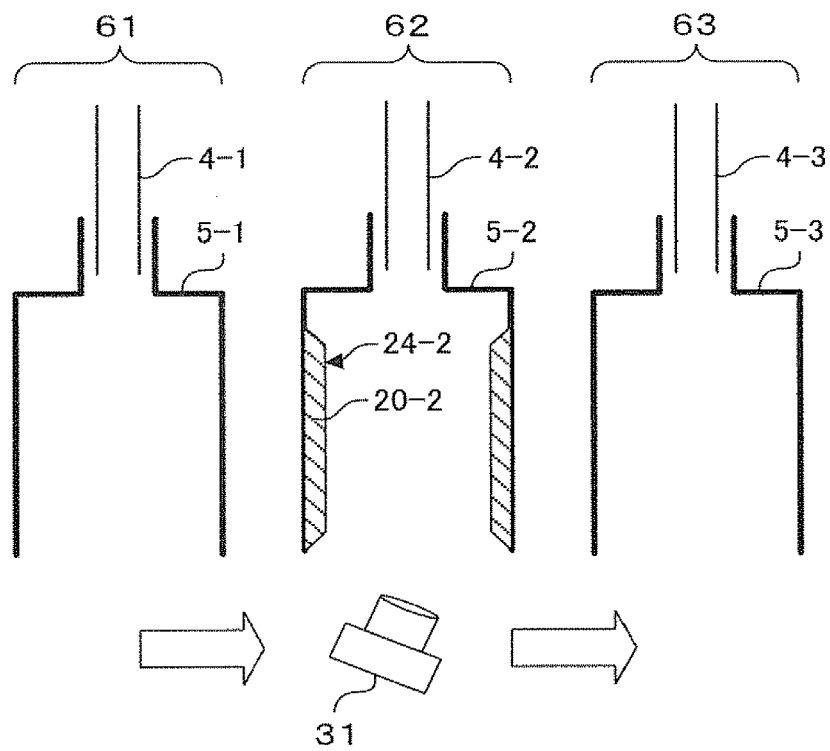


FIG. 7

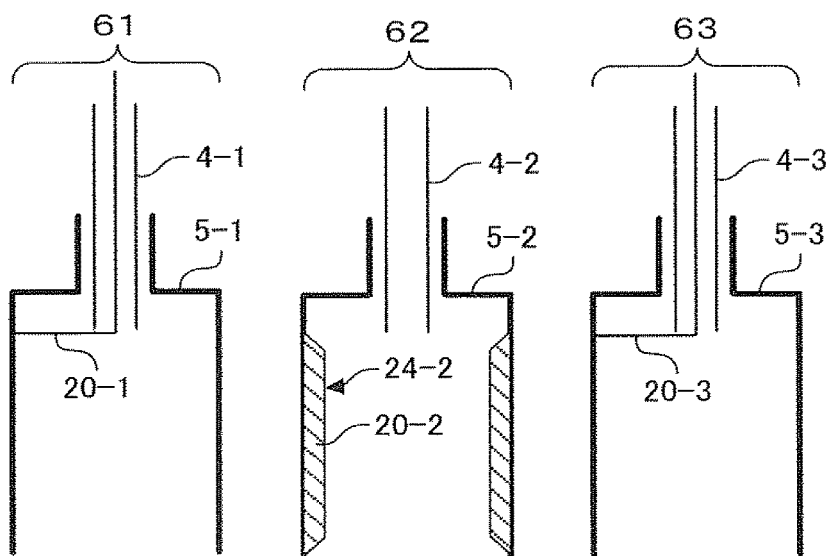


FIG.8

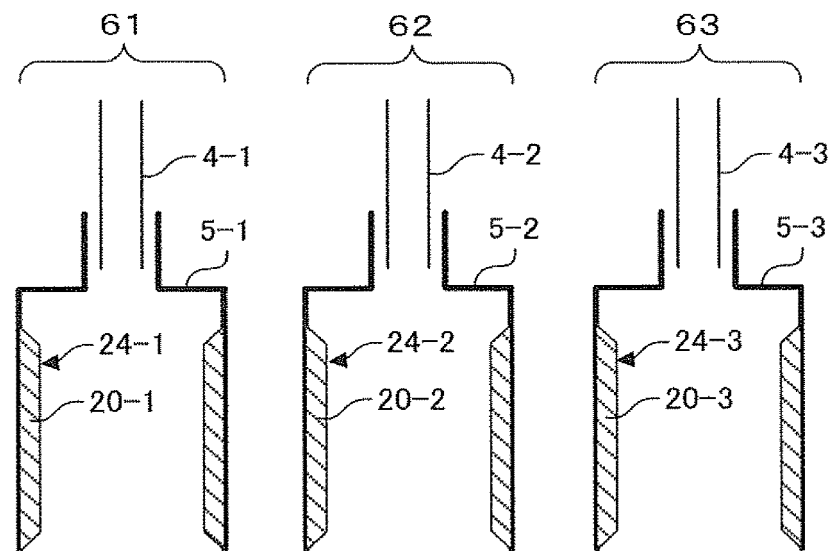


FIG.9

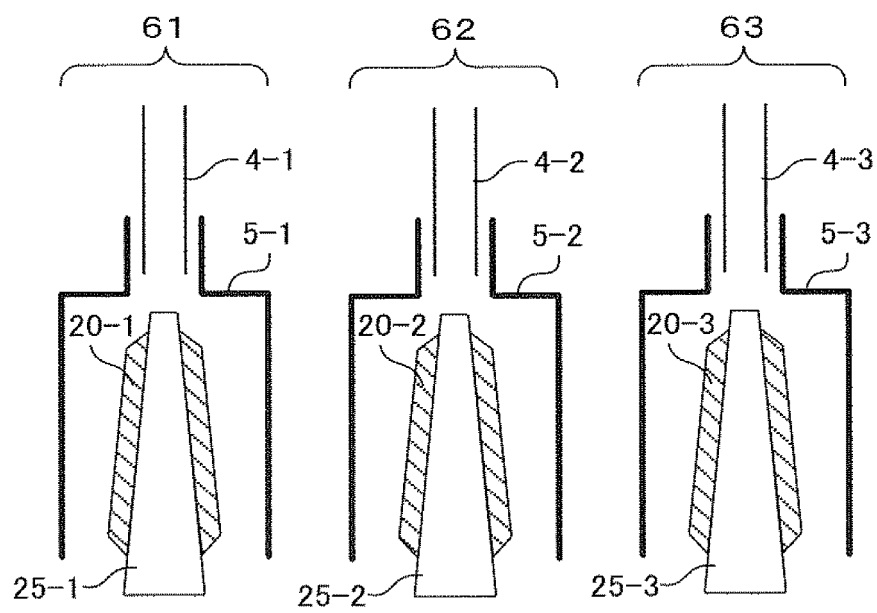


FIG.10

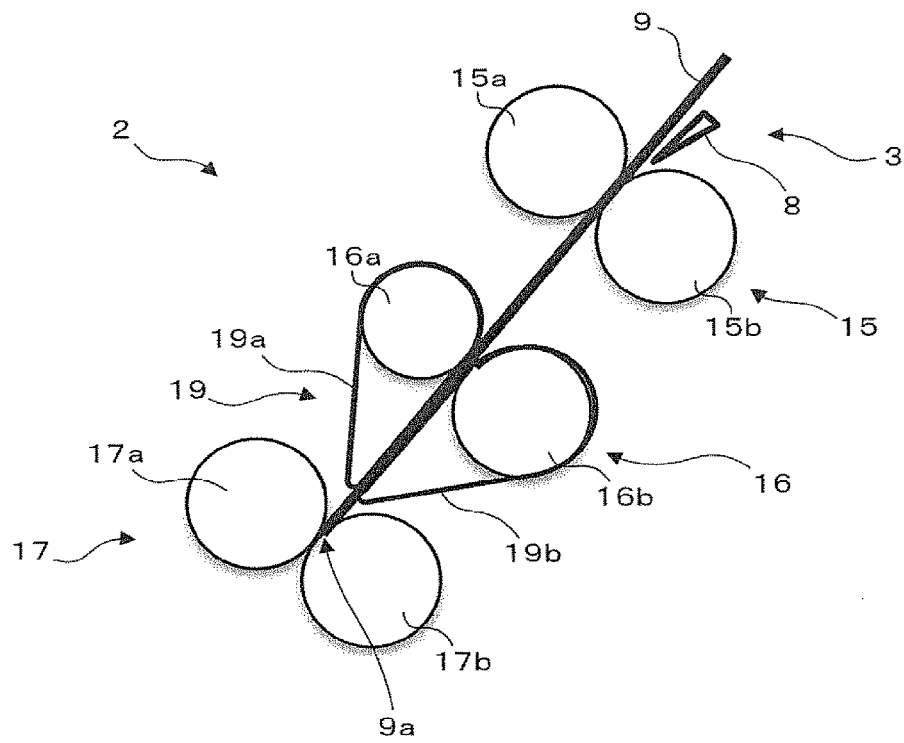


FIG.11

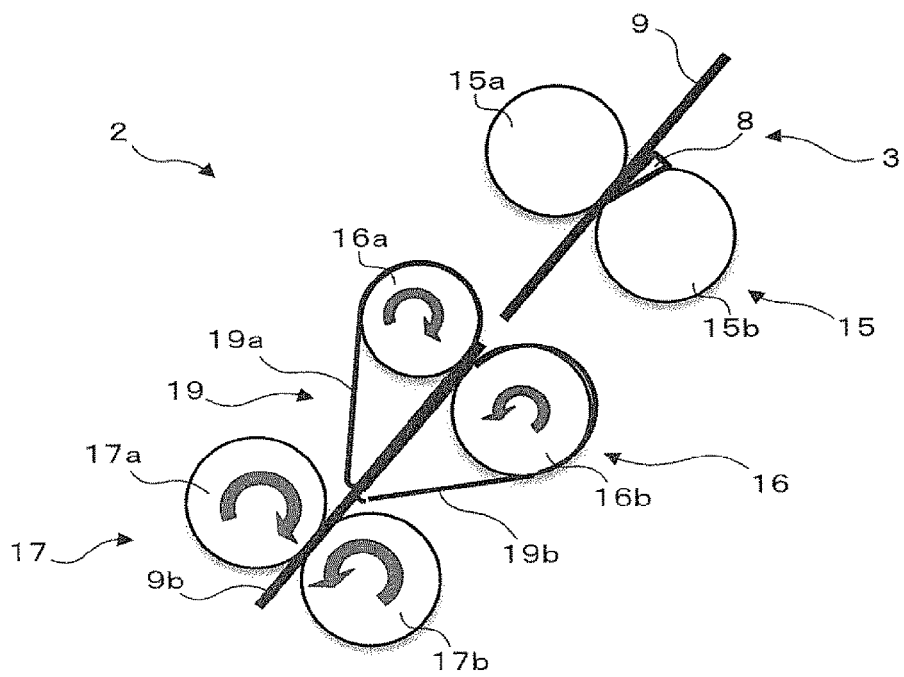


FIG.12

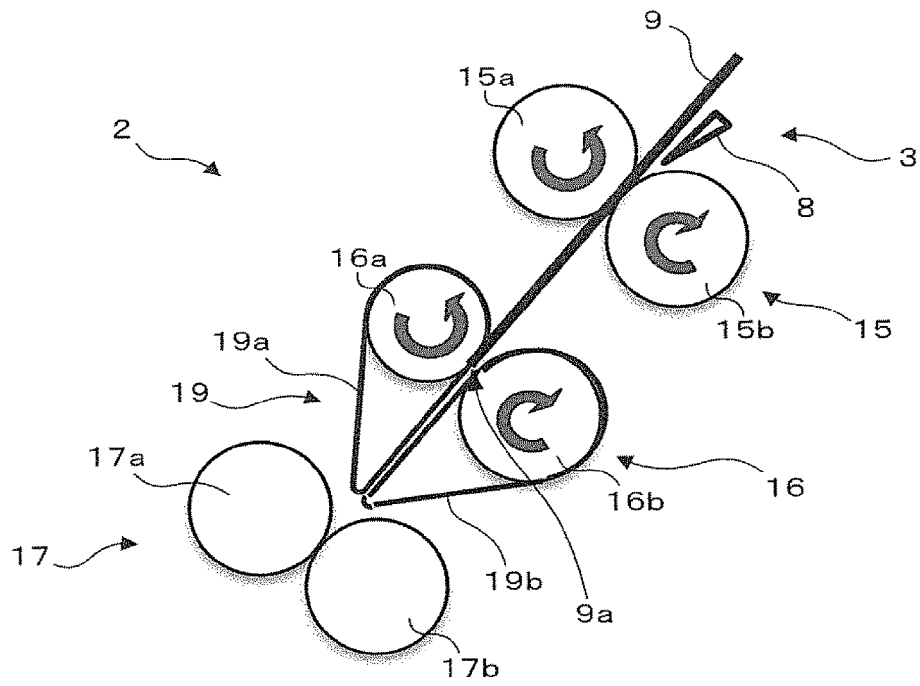
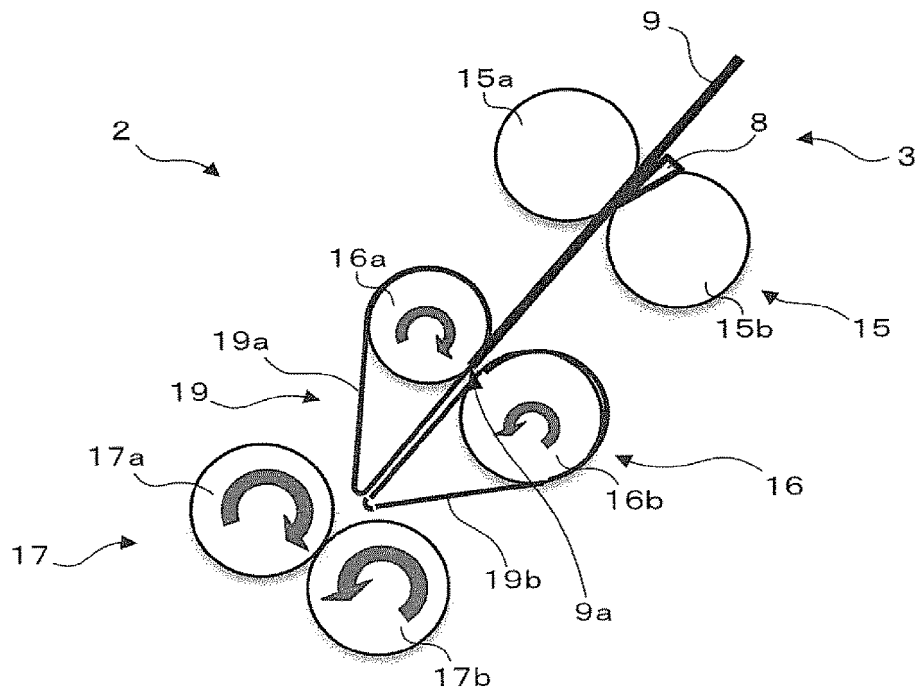


FIG.13





EUROPEAN SEARCH REPORT

Application Number
EP 19 19 1654

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 03/078706 A1 (SCHLAFHORST & CO W [DE]; BRUSS KARL-HEINZ [DE]; KOLTZE KARL [DE]) 25 September 2003 (2003-09-25) * page 4, paragraph 2 * * page 5, paragraph 4 - page 6, paragraph 1 * * page 10, paragraph 1 - page 13, paragraph 1; figure 1 * -----	1,4,5	INV. D01H1/08
A,D	EP 1 076 123 A1 (SCHLAFHORST & CO W [DE]) 14 February 2001 (2001-02-14) * paragraph [0027] - paragraph [0041] * * claims 1, 9 *	1-5	
A	DE 44 00 999 A1 (KOENIG R) 20 July 1995 (1995-07-20) * column 3, line 6 - column 3, line 26 * * column 5, line 32 - column 5, line 47 * * claim 10 *	1,2	
A	EP 0 931 864 A2 (SCHLAFHORST & CO AG W) 28 July 1999 (1999-07-28) * paragraphs [0024], [0028], [0050]; figure 1 * -----	1	TECHNICAL FIELDS SEARCHED (IPC) D01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 17 January 2020	Examiner Todarello, Giovanni
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 19 1654

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-01-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03078706 A1	25-09-2003	AT 348905 T	15-01-2007
		AU 2003219073 A1	29-09-2003
		CN 1643194 A	20-07-2005
		DE 10211862 A1	02-10-2003
		EP 1488028 A1	22-12-2004
		JP 2005520938 A	14-07-2005
		WO 03078706 A1	25-09-2003

EP 1076123 A1	14-02-2001	CN 1284576 A	21-02-2001
		CZ 20002932 A3	14-03-2001
		DE 19938433 A1	15-02-2001
		EP 1076123 A1	14-02-2001
		JP 2001081634 A	27-03-2001
		US 6389788 B1	21-05-2002

DE 4400999 A1	20-07-1995	AU 1412895 A	01-08-1995
		DE 4400999 A1	20-07-1995
		DE 19580016 D2	27-02-1997
		WO 9519459 A2	20-07-1995

EP 0931864 A2	28-07-1999	EP 0931864 A2	28-07-1999
		ES 2159199 T3	16-09-2001
		JP 4240622 B2	18-03-2009
		JP H11256434 A	21-09-1999
		RU 2215072 C2	27-10-2003
		US 6109014 A	29-08-2000

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2001081634 A [0004] [0005]